Strategy Research Project

AGILE AIRMEN: DEVELOPING THE CAPACITY TO QUICKLY CREATE INNOVATIVE IDEAS

BY

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ABSTRACT

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AGILE AIRMEN: DEVELOPING THE CAPACITY TO QUICKLY CREATE INNOVATIVE IDEAS

> In any problem where an opposing force exists, and cannot be regulated, one must foresee and provide for alternative courses. Adaptability is the law which governs survival in war as in life—war being but a concentrated form of the human struggle against environment.[1]
>
> —B. H. Liddell Hart

The ability to quickly leverage creative ideas ahead of one's opponent is a cognitive ability called "mental agility."[2] Today's senior service leaders increasingly emphasize the need to transform to a modern total force of agile-minded personnel who can operate in more complex forms of warfare against current and emerging enemies. The Capstone Concept for Joint Operations (CCJO), the Army Capstone Concept, the 2010 Combat Air Force Strategic Plan, and the 2010 Naval Operations Concept all call for an agile force to achieve policy objectives. Each of these concepts uses descriptors such as innovative, adaptive, flexible, and ingenuity of its organizations and people to express the need to develop agile-mindsets.

This paper addresses the importance of an agile mindset to the national defense and presents an option to help ensure that the United States (US) armed forces has the airmen necessary to support joint aerospace operations with sister services and across the military reserve components. The first part of this paper introduces the Agile Airmen vision by examining four theories that frame the relationship of mental agility to security implications of the future joint operational environment. The second part presents a policy proposal for achieving the Agile Airmen vision.

The joint cohort of US military and civilian aerospace professionals—referred to herein as "airmen"—have long fixated on acquiring increasingly advanced weapons and

related support systems as a substitute, rather than a complement, for higher cognitive abilities. In a 2009 speech to the Air Force Association, Secretary of Defense Robert Gates warned airmen not to engage in the kind of "techno-optimism that has muddled strategic thinking in the past."[3]

The Net-Centric Operations (NCO) concept is an example of how techno-optimism can rise to doctrinal levels that resemble religious dogma. The context of NCO, as illustrated in *Joint Vision 2010* (*JV2010*), was an enabling technology to counter national mechanized armed forces. The allure of the NCO concept, according to *JV2010,* was that networked information technology would curtail time or need to mass forces in an objective area by increasing precision targeting and precision effects of weaponry.[4] Several NCO studies extol its synergistic benefits for substantially increasing battlefield situational awareness and simplifying personnel deployment processes. After investing billions of dollars to operationalize NCO, however, there is no empirical data that it has equitably decreased the force employment numbers or deployment durations.[5]

The Agile Airmen Vision

The Agile Airmen vision is to champion the development of a pool of new recruits with high cognitive abilities who are creative and can innovate successful cross-dimensional approaches in air, space and cyberspace domains. Battles are lost when leaders underestimate their enemy and those enemies use unexpected approaches. The United States began this century with a violent reminder that its agile minded enemies will use unexpected approaches. On September 11, 2001 an innovative non-state actor leveraged against vulnerabilities in America's aerospace superiority complex by using a cunning plan to turn passenger conveyances into missiles. For airmen to

defeat future agile minded enemies they need the cognitive ability to quickly adapt to unfamiliar threats and unexpected conditions. To achieve the Agile Airmen vision, this paper proposes that the US Department of Defense should create its own education program to develop highly intelligent young Americans to become future leaders for the US armed forces or the defense industrial complex.

The need to develop mentally agile aerospace leaders starts with the military's vision document *Capstone Concept for Joint Operations (CCJO)*. The purpose of the *CCJO* is to prepare the armed forces to deal with future threats by identifying trends in the joint operating environment (JOE). The Chairman of the Joint Chiefs of Staff and other senior service officials agree the most likely conditions in the JOE are uncertainty and complexity compounded by accelerating change.[6] Most capstone documents, to include the latest *Quadrennial Defense Review (QDR)*, and the subordinate documents that flow from it, all describe the JOE in similar terms. Assuming those conditions hold true, airmen should expect to face bewildering threats in the JOE that will require agile mindsets to win the proverbial high-ground for aerospace dominance. Rephrasing author Lewis Carroll's fanciful prose between the agile Red Queen and Alice (of Wonderland) about navigating her strange chessboard world illustrates the cognitive challenge that airmen face. "Now, *here,* it takes all the thinking you can do to keep in the same place," said the Queen. "If you want to get somewhere, you must *think* at least twice as fast as that!"[7]

Fast, or deep, thinking about the future strategic environment inevitably leads one to reflect on China's appetite for regional hegemony. Although the jury is still out about China's status as a friend of foe, the demonstrated capabilities of its anti-satellite,

anti-air and anti-ship weaponry foreshadow the accelerating pace of change in the JOE and the cognitive puzzles that will challenge airmen for years. Secretary Gates' assessment about China's arms build-up is that "[w]e should be concerned less with [China's] potential ability to challenge the U.S. symmetrically and more with their ability to disrupt our freedom of movement and narrow our strategic options"[8] The Secretary portrayed China's asymmetric military options as a predicament when it could present an opportunity to balance North Korea's aggression if US diplomacy can influence Chinese leaders to act responsibly in that role. Dealing with China's rise as a predicament is an alternative but a better option is to envision a new kind of creative opportunity from it. The adage "turn lemons into lemonade" exemplifies the cognitive difference between recognizing predicaments or opportunity.

In their research, professors Gerard Puccio, Mary Murdock and Marie Mance of the International Center for Studies in Creativity at Buffalo State College formed a relationship between creative thinking and problem solving. Their model, shown in Figure 2 classified problems by the complexity of thought required to produce a solution.

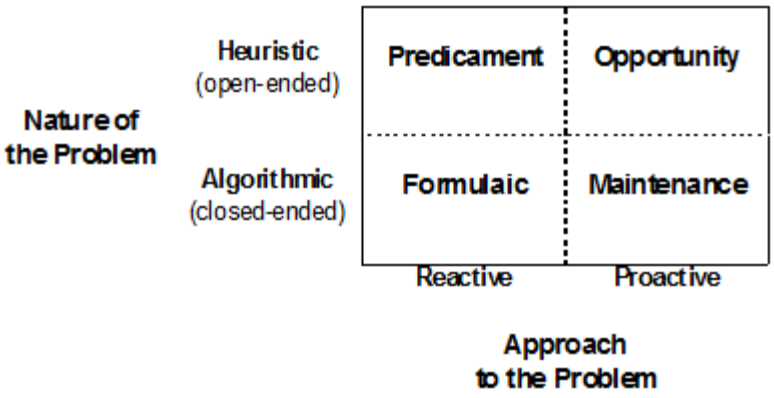

Figure 1: Types of Problems[9]

Their model positions “Formulaic” problems at the low end of the cognitive problem solving spectrum. Formulaic problems, they say, are solved reactively using a prescribed rule like refueling orbiting intelligence satellites when ground-based indicators show that propellant is running low. Next in complexity are “Maintenance” scenarios. These actions proactively mitigate the chance that something will become a problem, such as adding new military navigation satellites to the existing constellation before retiring old ones. “Predicament” scenarios are open-ended events that require a reactive, but yet unknown response like protecting communications satellites against anti-satellite missiles. Finally, “opportunity” scenarios are at the highest end of the cognitive learning spectrum because they require proactive, creative thought to discover advantages that did not previously exist. A controversial opportunity example is weaponizing space with offensive systems like hyper-velocity armored spears that can fall to Earth with the kinetic force of a nuclear bomb. The difference in cognition between predicament and opportunity scenarios is a matter of creative perspective.

Comparing China’s operational strategy, nicknamed “The Assassin’s Mace,” to a US Air Force and Navy “AirSea Battle” concept illustrates the mindset to devise opportunities rather than react to predicaments. Chinese leaders proactively created an “Opportunity” scenario to change the security balance in favor of their national interest vis-á-vis control over Taiwan’s independence. That opportunity came in part from the convergence of the diminished US military basing in the Western Pacific region and current US financial woes.

A 2009 RAND Corporation report “A Question of Balance” describes China’s proactive modernization effort to create overlapping layers of long and short range

aerospace capabilities to thwart US air superiority over Taiwan. The Assassin's Mace, they explained, is a strategy to expand China's geostrategic depth beyond Guam by enlarging the long range missile threat envelope. Enlarging the threat envelope pushes US air and naval forces east of Guam, which is beyond their operational ability to quickly project power in defense of Taiwan.[10] Meanwhile, any US forces that remain near Taiwan are vulnerable to surprise preemptive attacks from China's steadily growing arsenal of short range offensive capabilities. Compounding this strategy is China's new capability to destroy satellites with missiles, which would effectively blind airmen to China's next move.

In contrast to China's opportunistic move, US Air Force and Navy leaders are reacting to this scenario as a predicament with an operational concept called "AirSea Battle" to counterbalance China's asymmetric advantage.[11] The intellectual challenge for airmen is how to overcome the 'tyranny of distance' combined with overwhelming firepower to secure aerospace superiority for regional stability. China's strategy is very 'Reaganesque' in how it attempts to lure the US into an arms build-up that it cannot afford. While the details of the AirSea Battle concept have yet to emerge, it will likely come at a cost that vastly exceeds the benefit of creating opportunity over reacting to China's next move. For example, a collective regional security cooperation accord with China whereby it balances North Korea's aggressive stance toward South Korea is an illustration of creating opportunity that has both political and economic advantages in the Pacific region.

In *The Innovator's Dilemma*, Harvard Business School professor Clayton Christiansen described "disruptive innovations" as a strategy whereby a competitor

aggressively leverages simple, ingenious ways to overtake a more dominant organization.[12] Christiansen explained that these organization's leaders often fail to overcome disruptive innovations because they do not understand the conditions and forces that allowed a business competitor to overtake them.[13] Amazon.com is a recent business example of a disruptive innovation that transformed traditional retail and resale industry practices from brick and mortar marketplaces to a global, virtual market-space concept. A historical military representation of a disruptive innovation is 'skip bombing.' In World War II, bombing Japanese ships from high altitudes above Japanese anti-aircraft fire had little effect because most of the bombs missed their targets. That ended when airmen envisioned the possibility of descending to just above the ocean and releasing the bombs so that they skipped like stones on top of the water until they exploded against or near the ship's hull.[14] They then used it to great effect for sinking moving Japanese naval vessels during 1943's Battle of the Bismarck Sea. Christiansen's advice is that organizational leaders can steal the competitive edge by employing disruptive concepts against rivals before they understand and subsequently counteract the disruption.

Operationalizing new concepts in the JOE demands a superior situational understanding called 'decision superiority.' An instructive example of this point is Colonel John Boyd "OODA loop" theory. Colonel Boyd modeled his theory about orienting the fighter pilot's mind in the combat environment on the airman's cognitive agility with the necessity to make effective decisions faster than one's opponent.[15] His quick decision cycle theory—Observe, Orient, Decide, Act (then repeat)—requires speedy thinking blended with expert technical skills for decision superiority at all levels

of war and across all domain. Boyd concluded that whichever opponent can make good decisions the fastest will win the battle.

The future JOE requires that US airmen maintain decision superiority across the air, space and cyber domains. Of those three, the cyberspace domain presents a unique cognitive challenge that demands agile mindsets because attacks and defenses move quite literally at the speed of light. Once cyberspace attackers can leverage network vulnerability, they can swiftly cripple an airman's freedom of action and thus diminish the ability to apply Boyd's OODA theory to regain the advantage.

The preceding section examined four theories that frame the need for the Agile Airmen vision. The *CCJO*, Puccio et al., Christiansen, and Boyd form a creative leadership model that defines the Agile Airmen vision as the cognitive ability to think flexibly, understand changing conditions, produce novel ideas, and act quickly on them to create disproportionate advantages. However, this description does not characterize the typical recruits who join to become airmen, so aerospace institutions must provide them with a lengthy regimen of education, training and experience in order to give them the support and resources need to develop and hone their skills.

Celebrated artists, athletes, and performers are just a few subsets of the people who had the good fortune to be recognized as masters of a skill. Of course most young people only form a basic familiarity in such skill areas but never reach world-class mastery. Closing the divide between them is possible but it takes a lot of practice to do so. In *Outliers*, author Malcolm Gladwell explained that mastery requires roughly 10,000 hours of practice.[16] Gladwell found that it takes world-class artists and athletes ten years to put in 10,000 hours of practice. More importantly, he observed that mastering a skill

requires support and resources in addition to a lot of practice. His message is that masterful experts earned their positions with help from others, which makes them anything but outliers. This recipe is also how aerospace institutions can develop new agile airmen.

Airmen may have “slipped the surly bonds of Earth” but they are anything but outliers.[17] Many more achieve mastery given opportunity. The armed forces provide their airmen with the world’s best specialized training and educations so that they can use their weapons effectively. Consider the pantheon of pioneering aerospace thinkers like James Doolittle (Army Air Corps), Hap Arnold (Army), Carl Spaatz (Air Force), Washington Chambers (Navy) and Theodore von Kármán (a civilian jet propulsion expert and the first chairman of the US Army Air Corps Science Advisory Group). Their respective institutions provided them with funding, opportunity and encouragement from which they could think creatively how to exploit their innovations.[18] Perhaps most importantly, they led new organizations to develop creative thinkers for progressively more sophisticated technology that they knew would follow.

Employing today’s innovative weapons requires even more specialized knowledge in order to comprehend how to make them work effectively. For example, developing new aviators and space operations specialists takes up to two years just to finish core training schools (e.g., officer training school, undergraduate navigator training, weapon system training) prepare them to enter their first operational unit. This developmental model worked well to gain comprehension of the underlying technology principles so long as airmen were sufficiently educated before accession.

America's competitive edge is increasingly dependent on its innovative edge, but there is a growing risk to the talent reservoir. Research findings reported by the United States Mission to the Organization for Economic and Co-operation Development (OECD) reveals a disturbing trend that US middle school and high school students are habitually under-performing when compared with their international peers in science and math achievement measures.[19] In 2009, US students ranked 31st in math literacy and 23rd in science literacy among their industrialized peers from 65 OECD member countries.[20] "The hard truth," Secretary of Education Arne Duncan said about the disappointing results, "is that other high-performing nations have passed us by during the last two decades…America's students are effectively losing ground."[21] Bill Gates, founder of the Microsoft Corporation, also expressed concerned that "too few young people are acquiring the knowledge they need to use technology in creative and innovative ways."[22] He lamented that "this is a critical problem because technology holds the key to progress." President Barack Obama's appraisal of the situation is that "we are not advancing as we must" and he wants the US back on top within a decade.[23]

According to the President's 2009 *National Security Strategy*, advancing US national security priorities in an increasingly competitive global environment depends on building strong security and economic capacities.[24] The president's security assessment is congruent with the Commission on Professionals in National Security, which reported that over 50% of America's sustained economic growth comes from science, technology, engineering and math (STEM) professions.[25] That makes economic prosperity truly the lifeblood of US national security. But not everyone agrees that improving STEM skills correlates to national economic prosperity.

A comparative analysis of OECD economic data and UNESCO data on student enrollment in STEM college courses for the years 2000-2008 show a negligible correlation between STEM students and economic growth.[26] In contrast, a 2008 statistical analysis finds a high correlation to economic growth. Eric Hanushek and Ludger Woessmann studied cognitive-skill in math and science versus GDP growth in 50 countries (which includes the entire subset of OECD countries) back to 1960 and found that raising those skills significantly improved economic growth. Figure 2 displays their results in terms of real GDP growth against average scores on international math and science tests. President Obama's administration also asserts that improving STEM achievement is vital to the nation's prosperity, especially now that the US is a knowledge-based society.

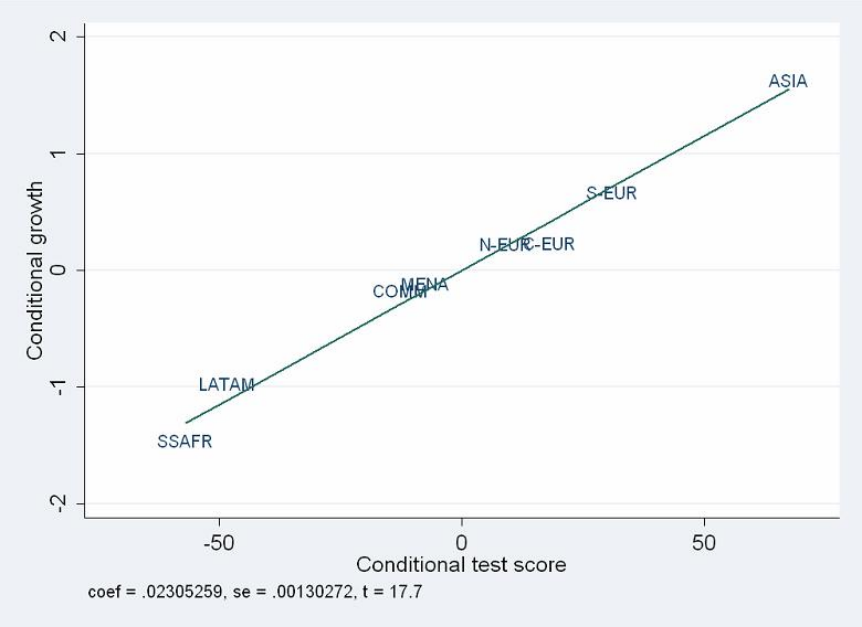

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Figure 2: Cognitive Skills and Growth Across World Regions[27]

Protecting the national security therefore requires that the US remains a leading catalyst of cutting edge ideas and innovations, but there is very little time remaining in career development models to help airmen who joined as low-achievers to become creative thinkers. Today's airmen have many demands in their development plans. They include basic military training, primary weapon system and associated technical skills training, additional on-the-job technical and administrative training, temporary duties, exercises, operational employment, command, learning foreign language and area-studies training, staff duty, joint and interagency assignments and professional military education—just to name a few.

In a 2009 article, Admiral James Stavridis and Captain Mark Hagerott commented that there's just not enough time in a career to "do it all."[28] They present a valid concern that there are limits to how many diverse experiences that the institutional military can bundle into a typical career and still produce adaptable professionals. In his monograph, "Developing Adaptive Leaders: The Crucible Experience of Operation Iraqi Freedom" Dr Leonard Wong, reveals that war experience is developing adaptability skills in junior leaders. He explained that an ongoing combat environment uniquely presents complex and unpredictable conditions, which thrusts them into new roles that they do not learn while training in garrison. Absent the crucible of war, how will the Air Force ensure that they will have sufficiently agile airmen for future battles?

The answer lies in the concepts provided by the CCJO, Boyd, Puccio et al. and Christiansen, but one must acknowledge that high school student achievement in STEM knowledge is declining while the need is increasing. It is implausible that the armed forces will slow their acquisition of new technologies to give recruits time to catch up.

That approach is fraught with the unacceptable risk of losing a crucial security advantage known as “Full Spectrum Dominance.”[29] The agile Red Queen’s answer is instructive: “If you want to get somewhere, you must think at least twice as fast!”

A Policy Proposal to Achieve the Agile Airmen Vision

Developing highly intelligent young people to be Agile Airmen should be a vital component of maintaining the US military’s competitive edge. To maintain full spectrum dominance the Department of Defense should carefully seek, encourage and provide resources for students with high intellects to specialize in science, technology, engineering and math during their early education. “Intellectually gifted” students have an “above average” innate ability to learn significantly faster than their cohorts, and thus have the potential for greater academic achievement.[30]

Senior leader perspectives about the JOE and its implications on developing airmen portend that the US national security depends on young people who earn high achievement scores in STEM competencies. A new report from the National Science Board titled “Preparing the Next Generation of STEM Innovators” also emphasizes that gifted students “will form the next generation of STEM innovators.”[31] The report goes on to stress that the nation's prosperity, security, and quality of life depends on identifying and developing children with STEM skills. President Barack Obama’s *National Security Strategy* also recognizes that America’s declining student achievement is an important national security challenge that demands reform to restore America’s leadership in higher education and scientific innovation.[32]

The National Science Board’s 2010 assessment combined with the Hanushek and Woessmann analysis identified STEM leaders as vital to America’s long-term prosperity, but having quality teachers who can teach STEM subjects is conclusively

vital to improving student learning. A 1999 analyses commissioned by the Center for the Study of Teaching and Policy, established teacher professional development and certification as the strongest correlates to student achievement.[33] In addition to the National Science Board's report, other research evidence by the Belin-Blank Center for Gifted Education and Talent Development revealed that when children with high intellects are locked in an age-based curriculum, rather than an ability-based curriculums, they fail to achieve their mind's full potential.[34] The nation's education system has long held a responsibility to meet the educational needs of all students, which means that this equity doctrine unfortunately shortchanges the different learning needs of America's future innovators. Consequently, middle and high school students are not learning the right skills to fill growing demands, which may result in a generational gap of STEM leaders.

Since teaching reform is critical to increasing student performance, teachers must first master STEM content in order to produce a learning environment that nurtures student learning. Teachers who master STEM content are better informed and thus better able to teach advanced courses that challenge students to perform better.[35] Also, students learn better from teachers who have degrees, especially masters degrees, in the subject area that they teach. School administrators complicate the problem by hiring teachers with general education degrees rather than degrees in STEM subject areas even though the 2007 and 2010 America COMPETES Act added $88 billion to improve teacher's education to instruct STEM subjects. Absent another 'Sputnik Moment' that generates self-inspired reform for STEM achievement, the

President launched two additional campaigns to regain lost ground in teacher effectiveness and student interest respectively.

President Obama's first campaign, "Race to the Top," was a $4.35 billion contest for select states to stimulate educators and legislators to raise the bar for college preparatory standards.[36] The US Department of Education describes Race to the Top as a competitive grant program designed to encourage and reward States that "have demonstrated success in raising student achievement and have the best plans to accelerate their reforms in the future."[37] The President's other campaign, "Educate to Innovate," focuses on improving student and teacher interest in STEM activities outside the classroom.[38] It is a $260 million public-private partnership that leverages corporate goodwill to provide after school activities to spur STEM literacy, teacher quality, and opportunities for underrepresented groups.

Despite all the cheerleading, the efficacy of either campaign to enact meaningful closure on the achievement gap is still unknown and also unlikely. The US already spends more money per student on pre-collegiate education than most countries, so spending more money on the traditional one-size-fits-all teaching model for is unlikely to ignite a national reform movement that makes nurturing bright minds a priority. Most schools did not receive any benefits from either initiative, and hence have monetary incentive to develop an urgency to improve STEM education. The states that did receive funding made a few commitments to raise education standards, but their stated focus is on low achievers.[39] Student achievement results shows that the nation's current education system is not meeting the needs of low and high achievers alike, and America's brightest minds will not succeed on their own.

To ensure that the US armed forces has sufficiently agile-minded leaders, this paper proposes that DOD invest in gifted education by creating small public academies at all US colleges where high-intellect (gifted) 12-18 year old pupils can learn to become aerospace leaders in the armed forces or defense related industries. These academies should be specifically reserved for the students with the highest cognitive potential, just as varsity teams are reserved for athletes with the highest physical talent. Some may argue that educating gifted students in this manner is elitist, but it is really just analogous to the five military service academies that currently enjoy widespread praise for producing leaders.

With the right funding strategy, the proposed academies could provide an educational intervention that applies differentiated instruction and accelerates learning for an estimated 120,000 highly gifted American students (children of IQ 145 appear at a ratio of 1 in 1,000) commensurate with their higher intellectual aptitude.[40] This proposal differs from the US Service Academies in two primary ways. The first difference is that they are non-resident day schools with personalized learning plans for highly gifted children that oriented toward mastering aerospace fields of study and research. The other primary difference is that students are not grouped by graduation year group as with military academy cadets. A student's intellectual ability to progress in any subject area determines which level of instruction they receive, to include upper-level collegiate courses. A key advantage of the dual enrollment aspect is it allows students to graduate a baccalaureate program faster and proceed to graduate school where they can conduct important aerospace research. Students who desire to enter

military service immediately after graduation could enroll in Reserve Officer Training Corps electives or attend an Officer Training School.

Educating gifted students at colleges using an accelerated learning program ensures that their ability to learn quickly does not outstrip the institution's ability to provide adequate instruction. Using college infrastructure and professors creates the right learning environment for America's brightest minds while also maintaining children in their nurturing home environment. Decades of federal investments in US colleges via research grants, the GI Bill and Pell Grants has produced a surplus of college classrooms, laboratories and other amenities all across America. Some colleges, like those in the University of Florida system, have 50% excess infrastructure and are seeking ways to use it effectively for higher learning.[41] Assuming that only three quarters of the 2,719 four-year colleges in America can accommodate these 120,000 gifted students, it would encumber the participating campuses with just 60 pupils each.[42] Keeping each academy the size of a small ROTC detachment should not overwhelm any one campus, yet it would make the education accessible to more students. Most US colleges eagerly accept gifted students, so leveraging their existing infrastructure benefits the college and offers a shrewd dividend to taxpayers created by decades of investments from many federal sources. Adding these academies to 10 USC § 983, the federal statute that denies federal financing to colleges that prohibit ROTC or military recruiters on campus, should also incentivize colleges to welcome this initiative.[43]

To facilitate the US winning the race to the top and its preeminence, the US Congress should consider funding this proposal. An amount equal to just one-half of the $4.35 billion Race to the Top campaign would finance the proposed academies for a per

pupil cost of $18,125. By comparison, the US spent an average of $12,018 per student in 2010, but all of the local tax revenues that schools would have spent on educating gifted students could then go towards the vulnerable students whom schools commendably target now. This makes for a balanced strategy when one considers the national security benefit of an education program focused on developing Agile Airmen.

In conclusion, this paper argued that the US armed forces must develop intellectually gifted children to serve as tomorrow's Agile Airmen. Airmen love their high-tech weaponry systems and are often defined by them, but those systems are not a substitute for human capital with mastery in the right cognitive skills. Puccio et al. informed us that a creative mindset is needed to solve complex predicaments and envision opportunities. Christiansen further explained that leaders must foresee consequences and implications of disruptive innovations or lose their advantage. Lastly, Boyd warned that the cognitive ability to make effective decisions faster than one's adversary will win the battle. Today's aerospace leaders need to master all of those skills; however, as Gladwell noted, mastering a skill requires years of practice along with vast amounts of support and nurturing.

With proper attention to their early STEM achievement in the proper learning environment, gifted youth have the unique cognitive ability to be the Agile Airmen that the armed forces need to win battles in the complex, uncertain joint operating environment. DOD should consider creating the proposed academies because there is very limited time in an airman's career to develop the creative mindset to envision opportunities, understand the complexities behind disruptive innovations and quickly create effective solutions at levels way above global peers.

Endnote

[1] Peter G. Tsouras, *Warrior's Words: A Quotation Book: From Sesostris III to Schwarzkopf, 1871 B.C. to A.D. 1991* (London, UK: Cassell Arms and Armour, 1992), 21.

[2] U.S. Department of the Army, *Army Leadership,* Field Manual 6-22 (Washington DC, U.S. Department of the Army, October 2006), 6-1.

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